# High-resolution C-14 dating of a 25,000-year lake-sediment record from equatorial East Africa

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SI Table 1. Bulk organic $^{14}C$ dates from the Challa core. ID numbers are from Groningen lab (GrA) unless mentioned otherwise. Depths are adapted depths in cm. Blank cells indicate no measurement available. For bulk dates used for age offset estimates, see SI Table 2.

| Lab ID | depth | $^{14}C$ BP | error | d13C | %C |
|---|---|---|---|---|---|
| 38865 | 11 | 340 | 30 | -30.33 | 11.6 |
| Poz-4600 | 11.5 | 385 | 40 | -23.8 | |
| Poz-4826 | 11.5 | 400 | 25 | -25.8 | |
| 39326 | 13 | 390 | 35 | -28.58 | 15.5 |
| 39730 | 13 | 320 | 65 | -31.09 | 31.2 |
| 33181 | 19 | 395 | 30 | -30.65 | 13 |
| 35153 | 21 | 435 | 35 | -31.54 | 12.6 |
| 33182 | 23 | 495 | 35 | -31.62 | 9 |
| 35155 | 25 | 445 | 35 | -31.57 | 9 |
| 33183 | 27 | 390 | 30 | -31.14 | 13 |
| 33185 | 31 | 355 | 30 | -32.71 | 15.6 |
| 35165 | 33 | 440 | 35 | -31.33 | 10.7 |
| 33186 | 35 | 465 | 30 | -31.55 | 15 |
| 35157 | 37 | 480 | 35 | -31.7 | 13.1 |
| 33500 | 39 | 575 | 35 | -30.78 | 16.4 |
| 35160 | 41 | 530 | 35 | -31.86 | 9.3 |
| 33187 | 43 | 560 | 30 | -31.32 | 23.4 |
| 35146 | 45 | 520 | 35 | -32.25 | 12.1 |
| 33189 | 47 | 525 | 35 | -30.61 | 9.1 |
| 33191 | 51 | 610 | 30 | -31.07 | 9.1 |
| 33192 | 55 | 625 | 40 | -30.84 | 12.3 |
| 35147 | 57 | 580 | 35 | -30.91 | 14.3 |
| 33193 | 59 | 595 | 30 | -30.36 | 14.3 |
| 33281 | 63 | 665 | 35 | -28.37 | 8.2 |
| 35150 | 65 | 665 | 35 | -29.74 | 12.2 |
| 33282 | 67 | 615 | 30 | -29.35 | 11 |
| 33283 | 71 | 710 | 35 | -30.51 | 13.9 |
| 32069 | 75 | 795 | 30 | | 11.8 |
| 33286 | 79 | 775 | 30 | -30.82 | 10.8 |
| 33287 | 83 | 830 | 30 | -31.23 | 10.8 |
| 35166 | 87 | 910 | 40 | -32.36 | 12.7 |
| 35167 | 89 | 870 | 35 | -32.4 | 9.3 |
| 35169 | 91 | 860 | 35 | -32.78 | 13.3 |
| 35171 | 95 | 870 | 35 | -31.4 | 7.5 |
| 32066 | 101 | 1780 | 35 | | 13.6 |
| 35172 | 105 | 970 | 35 | -31.21 | 10.1 |
| UB-9012 | 117 | 1181 | 33 | -31.4 | 10.4 |
| UB-9013 | 119 | 1207 | 22 | -30.4 | 9.1 |
| UB-9014 | 121 | 1233 | 24 | -31 | 11 |
| 32240 | 123 | 1310 | 30 | -31.59 | 10.4 |
| UB-9015 | 125 | 1288 | 22 | -30.9 | 10.9 |
| UB-9016 | 127 | 1330 | 22 | -33.4 | 9 |
| UB-9017 | 131 | 1376 | 23 | -29.3 | 9 |

| Lab ID | depth | $^{14}$C BP | error | d13C | %C |
|---|---|---|---|---|---|
| 32071 | 149 | 1670 | 30 | -31.27 | 11.2 |
| 38866 | 185 | 2060 | 30 | -31.26 | 11.6 |
| Poz-5389 | 185.1 | 1795 | 35 | -26.7 | |
| 32072 | 201 | 2300 | 35 | -31.59 | 8.3 |
| UB-9018 | 213 | 2403 | 22 | -30.1 | 10 |
| UB-9019 | 215 | 2462 | 23 | -30.6 | 8.3 |
| UB-9020 | 217 | 2397 | 33 | -31.4 | 10.2 |
| UB-9021 | 219 | 2444 | 21 | -30.6 | 8.5 |
| UB-9022 | 221 | 2383 | 21 | -32.9 | 9.41 |
| 33288 | 223 | 2495 | 35 | -31.09 | 9 |
| 33289 | 227 | 2530 | 35 | -30.15 | 13.8 |
| 35173 | 229 | 2550 | 40 | -30.7 | 16.1 |
| 33291 | 231 | 2645 | 35 | -31.35 | 17 |
| Poz-5390 | 233.6 | 254 | 40 | -29.5 | |
| 33292 | 235 | 2625 | 35 | -29.75 | 14.7 |
| 35175 | 237 | 2580 | 40 | -31.42 | 11.2 |
| 33293 | 239 | 2685 | 35 | -31.78 | 10 |
| 35176 | 241 | 2705 | 40 | -32.51 | 11.7 |
| 33296 | 243 | 2705 | 35 | -33.12 | 11.6 |
| 33297 | 247 | 2740 | 35 | -32.03 | 11.4 |
| 33298 | 251 | 2685 | 35 | -31.92 | 12.1 |
| 33299 | 255.3 | 2745 | 35 | -32.26 | 13.2 |
| 35177 | 257.5 | 2660 | 40 | -32.96 | 11.4 |
| 33301 | 259.6 | 2860 | 35 | -31.6 | 12.6 |
| 35178 | 261.8 | 2890 | 40 | -32.38 | 12.9 |
| 33302 | 263.9 | 2960 | 35 | -31.8 | 13.9 |
| 35180 | 266.6 | 2970 | 40 | -33.49 | 12.3 |
| 33303 | 268.2 | 2955 | 35 | -31.35 | 12.3 |
| 35182 | 270.4 | 2935 | 40 | -32.01 | 14.6 |
| 33305 | 272.5 | 3100 | 35 | -31.84 | 12.8 |
| 33307 | 276.8 | 3015 | 35 | -31.87 | 9.8 |
| 38867 | 279 | 3075 | 30 | -31.88 | 11.7 |
| Poz-4564 | 279.1 | 3050 | 35 | -34.4 | |
| Poz-4943 | 279.1 | 3110 | 35 | -27.8 | |
| 33308 | 281.2 | 3135 | 35 | -31 | 11.7 |
| 32073 | 301 | 3295 | 35 | -31.02 | 9.8 |
| 35183 | 351 | 3720 | 40 | -30.14 | 12.9 |
| 38877 | 367 | 3840 | 35 | -30.48 | 22 |
| 39344 | 367 | 3805 | 35 | -28.5 | 19.2 |
| 35185 | 373 | 3800 | 40 | -30.7 | 11 |
| 35186 | 375 | 3945 | 40 | -31.21 | 9.7 |
| 35187 | 387 | 4150 | 45 | -31.25 | 13.5 |
| 35189 | 389 | 4140 | 40 | -30.09 | 16.5 |
| 35190 | 395 | 4225 | 40 | -30.12 | 11.8 |
| 35191 | 397 | 4325 | 40 | -30.69 | 13.6 |
| 32075 | 401 | 4480 | 45 | -31.71 | 9.8 |
| 35213 | 403 | 4415 | 40 | -30.4 | 19.8 |

| Lab ID | depth | $^{14}$C BP | error | d13C | %C |
|---|---|---|---|---|---|
| 35214 | 405 | 4390 | 40 | -31.75 | 15 |
| 35215 | 411 | 4605 | 45 | -30.97 | 8.8 |
| 35218 | 413 | 4565 | 40 | -31.65 | 9.4 |
| 35219 | 415 | 4625 | 40 | -31.88 | 9.8 |
| 35209 | 451 | 4950 | 40 | -31.33 | 16.9 |
| 33312 | 500 | 5450 | 40 | -31.11 | 9.7 |
| 33313 | 502 | 5335 | 40 | -30.8 | 10.5 |
| 35208 | 504 | 5515 | 45 | -30.3 | 10.5 |
| 35210 | 524 | 5845 | 45 | -31.93 | 9.9 |
| 32078 | 574 | 6400 | 40 | -31.27 | 17.6 |
| UB-8748 | 588 | 6622 | 28 | -34.1 | 0.15 |
| 38878 | 592 | 6670 | 35 | -31.49 | 26.8 |
| 39327 | 592 | 6995 | 60 | -28.33 | 8.9 |
| 35211 | 624 | 7215 | 45 | -31.63 | 11.7 |
| 33318 | 651 | 7535 | 40 | -31.91 | 17.8 |
| 33319 | 653 | 7480 | 40 | -31.17 | 15.8 |
| 35225 | 655 | 7505 | 45 | -32.81 | 15.7 |
| 35277 | 691 | 8040 | 50 | -26.27 | 1.3 |
| 38856 | 691 | 8010 | 40 | -32.83 | 16 |
| UB-8749 | 703 | 8131 | 29 | -33.4 | 5.53 |
| UB-8750 | 719 | 8251 | 33 | -34.4 | 22.43 |
| 38857 | 727 | 8100 | 40 | -31.79 | 13.8 |
| UB-8751 | 727 | 8320 | 29 | -35.1 | 5.9 |
| 32081 | 741 | 8910 | 50 | -31.21 | 17.2 |
| UB-9023 | 747 | 8855 | 32 | -30.6 | 19.34 |
| UB-9024 | 751 | 9006 | 34 | -32.4 | 17.86 |
| UB-8752 | 753 | 9028 | 31 | -31.8 | 23.41 |
| UB-9025 | 755 | 8929 | 32 | -29.5 | 16.57 |
| 38881 | 757 | 9075 | 45 | -31.14 | 17.7 |
| 39345 | 757 | 9460 | 60 | -28.86 | 19.1 |
| UB-9026 | 759 | 9074 | 33 | -29.8 | 10.56 |
| UB-9027 | 767 | 9024 | 33 | -29.8 | 12.29 |
| UB-9028 | 771 | 9152 | 42 | -29.6 | 5.4 |
| UB-8753 | 777 | 9395 | 32 | -32.2 | 17.8 |
| 35229 | 791 | 9590 | 60 | -32.32 | 7.1 |
| 32089 | 841 | 9940 | 60 | -31.89 | 5.9 |
| 35220 | 891 | 10230 | 50 | -33.13 | 8.9 |
| 32091 | 941 | 10860 | 60 | -31.16 | 8.4 |
| 35221 | 991 | 11230 | 60 | -32.06 | 5.1 |
| 32082 | 1023 | 11850 | 70 | -32.05 | 14.1 |
| 35223 | 1043 | 12150 | 60 | -34.25 | 11.2 |
| 38885 | 1081 | 12550 | 50 | -32.31 | 10.2 |
| 39335 | 1081 | 12180 | 55 | -26.43 | 8.5 |
| 35230 | 1091 | 12790 | 60 | -31.85 | 6.6 |
| 35231 | 1141 | 13230 | 70 | -32.8 | 7.9 |
| 32084 | 1173 | 13620 | 80 | -31.31 | 8.5 |
| UB-8754 | 1183 | 13820 | 43 | -29.8 | 6 |

| Lab ID | depth | $^{14}$C BP | error | d13C | %C |
|---|---|---|---|---|---|
| 35270 | 1191 | 14000 | 70 | -28.52 | 5.6 |
| 38882 | 1193 | 13800 | 60 | -31.68 | 17.6 |
| 32092 | 1241 | 14430 | 80 | -24.82 | 5.5 |
| 38883 | 1291 | 14630 | 60 | -31.04 | 5.2 |
| 35271 | 1291 | 14650 | 80 | -32.11 | 4.8 |
| 32093 | 1341 | 14820 | 90 | -29.22 | 4.1 |
| 35272 | 1391 | 15280 | 80 | -28.87 | 5 |
| 32016 | 1441 | 15680 | 70 | -28.77 | 4.8 |
| 35273 | 1491 | 16110 | 80 | -30.88 | 3.9 |
| 32017 | 1543 | 16570 | 70 | -26.84 | 4.3 |
| UB-8755 | 1553 | 16897 | 49 | -29.8 | 6 |
| 38895 | 1557 | 16710 | 70 | -28.59 | 3.5 |
| 35275 | 1591 | 17320 | 80 | -30.5 | 7.1 |
| 38892 | 1635 | 17840 | 80 | -30.91 | 6.2 |
| 39339 | 1635 | 17525 | 80 | -25.39 | 7.5 |
| 38880 | 1641 | 17970 | 70 | -29.03 | 5.1 |
| 32083 | 1641 | 18000 | 120 | -32.05 | 6.4 |
| 35276 | 1691 | 17340 | 90 | -26.67 | 2.1 |
| 32018 | 1741 | 17920 | 80 | -26.11 | 1.9 |
| 35277 | 1791 | 18010 | 90 | -26.27 | 1.3 |
| UB-8756 | 1845 | 19723 | 70 | -27.8 | 3 |
| 38894 | 1847 | 19210 | 90 | -23.76 | 4.5 |
| 39723 | 1847 | 17565 | 135 | -24.42 | 11.2 |
| 38887 | 1849 | 19120 | 90 | -23.74 | 2.2 |
| 38888 | 1878 | 19320 | 80 | -28.06 | 3.3 |
| 35233 | 1878 | 20270 | 130 | -31.73 | 5.1 |
| 32021 | 1928 | 19790 | 90 | -27.72 | 2.8 |
| 35281 | 1962 | 20160 | 100 | -27.97 | 2.2 |
| 38890 | 2010 | 20650 | 90 | -28.35 | 5.6 |
| 32022 | 2012 | 20290 | 90 | -26.96 | 3.1 |
| 38891 | 2062 | 20990 | 100 | -29.86 | 3.8 |
| 35283 | 2062 | 21280 | 110 | -31.58 | 2.9 |
| 32088 | 2076 | 21180 | 230 | -27.97 | 1.3 |

SI Table 2. Radiocarbon dates within turbidites. These were not used in the final chronology (see text). Depths (uncorrected cm) are midpoints for dates on bulk-organic matter, and ranges for grass charcoal dates.

| ID | Composition | Depth | $^{14}$C age | error | $\delta^{13}$C | %C |
|---|---|---|---|---|---|---|
| 35205 | bulk | 485 | 5500 | 40 | -31.18 | 16.0 |
| 33309 | bulk | 487 | 6330 | 45 | -30.46 | 6.4 |
| 33311 | bulk | 489 | 6435 | 40 | -29.17 | 8.2 |
| 33832 | charcoal | 490-498 | 6000 | 60 | -16.83 | 51.1 |
| 33833 | charcoal | 490-498 | 5960 | 60 | -15.47 | 57.5 |
| 32077 | bulk | 501 | 6380 | 45 | -28.85 | 8.6 |
| 33834 | charcoal | 502-510 | 5730 | 50 | -16.81 | 47.8 |
| 33835 | charcoal | 502-510 | 5960 | 70 | -16.17 | 31.3 |
| 35224 | bulk | 675 | 7580 | 45 | -32.57 | 20.0 |
| 33314 | bulk | 677 | 8170 | 45 | -32.76 | 10.5 |
| 33316 | bulk | 679 | 8340 | 80 | -30.45 | 9.0 |
| 32079 | bulk | 701 | 7890 | 45 | -30.5 | 12.1 |
| 33837 | charcoal | 698-706 | 8010 | 100 | -17.53 | 49.9 |
| 32019 | bulk | 1901 | 19,630 | 80 | -24.88 | 3.0 |

SI Table 3. Lead-210 dates. Ages are at base of interval. Cumulative activity is expressed as below the interval. Supported $^{210}$Pb was estimated at 0.105 ± 0.0214 pCi/g, based on 4 samples. Total cumulative unsupported $^{210}$Pb activity was 10.2294 pCi/cm$^2$ (flux 0.3558 pCi/cm$^2$ yr).

| **Interval** | **Cum.mass** | **Unsup.activity** | **Cum.activity** | **Age** | **Sedimentation rate** | |
|---|---|---|---|---|---|---|
| **(cm)** | **(dry g cm$^{-2}$)** | **(pCi g$^{-1}$)** | **(pCi cm$^{-2}$)** | **(AD)** | **(mg cm$^{-2}$yr$^{-1}$)** | **(mm yr$^{-1}$)** |
| 0-1 | 0.0303 | 32.4024±2.5111 | 9.2467 | 1996.5±2.16 | 9.3±0.8 | 3.0864 |
| 1-2 | 0.0661 | 20.5923±1.0091 | 8.5103 | 1993.8±2.25 | 13.4±0.9 | 1.6920 |
| 3-4 | 0.1645 | 19.3831±0.7456 | 6.5758 | 1985.5±2.65 | 11.4±0.8 | 0.7047 |
| 5-6 | 0.3388 | 7.0670±0.2500 | 4.9907 | 1976.6±2.12 | 23.5±1.3 | 0.4338 |
| 7-8 | 0.4878 | 10.0225±0.4334 | 3.6292 | 1966.4±2.34 | 12.3±0.8 | 0.3005 |
| 9-10 | 0.6567 | 4.3847±0.0967 | 2.7118 | 1957.1±1.86 | 20.6±0.8 | 0.2346 |
| 11-12 | 0.8241 | 3.6572±0.1257 | 2.0695 | 1948.4±2.04 | 18.9±1.0 | 0.1949 |
| 13-14 | 0.966.2 | 4.3931±0.0977 | 1.4739 | 1937.5±2.40 | 11.5±0.7 | 0.1607 |
| 15-16 | 1.1018 | 2.2675±0.0616 | 1.1057 | 1928.3±2.17 | 16.2±0.9 | 0.1400 |
| 17-18 | 1.2049 | 1.9084±0.0596 | 0.8282 | 1919.0±2.54 | 14.6±1.0 | 0.1239 |
| 19-20 | 1.4084 | 1.0413±0.0409 | 0.6243 | 1909.9±2.62 | 20.0±1.5 | 0.1114 |
| 21-22 | 1.5598 | 1.2262±0.0476 | 0.4463 | 1899.1±3.33 | 12.4±1.2 | 0.0994 |
| 23-24 | 1.7220 | 0.7363±0.0341 | 0.3099 | 1887.4±4.12 | 14.4±1.7 | 0.0891 |
| 25-26 | 1.9004 | 0.3347±0.0257 | 0.2354 | 1878.6±4.77 | 23.3±3.5 | 0.0826 |
| 27-28 | 2.0684 | 0.4363±0.0279 | 0.1668 | 1867.5±6.50 | 13.2±2.5 | 0.0757 |
| 29-30 | 2.2360 | 0.2819±0.0242 | 0.1137 | 1855.2±9.21 | 13.8±3.7 | 0.0692 |
| 33-34 | 2.6037 | 0.1529±0.0233 | 0.0418 | 1823.1±20.33 | 10.0±5.6 | 0.0566 |